Space Weather Technical Forecast

Issued on Wednesday, 10 July 2024 at 13:26 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Increasing Chance of M-class flares (R1-R2; Minor-Moderate radio blackouts) throughout. Chance of G1/Minor Storm intervals days 3 and 4 (12-13 Jul).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity is Moderate with three M-class flares. There are eight numbered and two as yet unnumbered regions on the disc. AR3738 in the southeast is by far the largest and most complex region on the disc, showing a continued growth trend in penumbral area and beta-gamma magnetic configuration. This produced an M-class flare peaking at M1.5 at 10/0559 UTC. AR3743 also in the southeast but closer to the limb, is showing a slight growth trend in penumbral extent but appears relatively simple. There are two unnumbered regions which appear simple, with the rest of the numbered regions on the disk also appearing small and magnetically simple.
No significant Earth-directed CMEs have been observed during the past 24 hours.

Solar Wind / Geomagnetic Activity: Solar winds as observed by ACE at L1 were indicative of background conditions. Speeds were slow-ambient around 350-400 km/s, but have now risen to slight elevated around 410 km/s. Density was below average. The Interplanetary Magnetic Field, Bt, was weak, and mostly below 6nT. The north-south component, Bz, varied weakly between +5/-5nT. The phi angle was rather variable but mostly negative (toward the Sun). The resulting geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES18 remained at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 was at mostly background levels. The 24-hour fluence was below Active, with 1.96e6 integrated pfu observed at 10/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be at Low to Moderate levels, with a slight chance of becoming High from any isolated X-class flares, which are most likely to originate from the large, centre-disc sunspot region, AR3738.

Solar Wind / Geomagnetic Activity: No significant Earth-directed CMEs feature in the forecast. The solar wind at mostly slightly elevated perhaps briefly Elevated speeds for the next couple of days due to negative polarity coronal hole high speeds streams. During Day 3 or on day 4 (12-13 Jul) a further, likely faster and perhaps more impactful coronal hole high speed stream is expected to arrive bringing Elevated solar wind speeds.
Geomagnetic activity is expected to be mainly Quiet to Unsettled (Kp1-3) through the period. The Chance of Active to G1/Minor storm intervals (Kp4-5) increases by days 3 and 4 (12-13 Jul) due to successive coronal hole fast wind enhancements.

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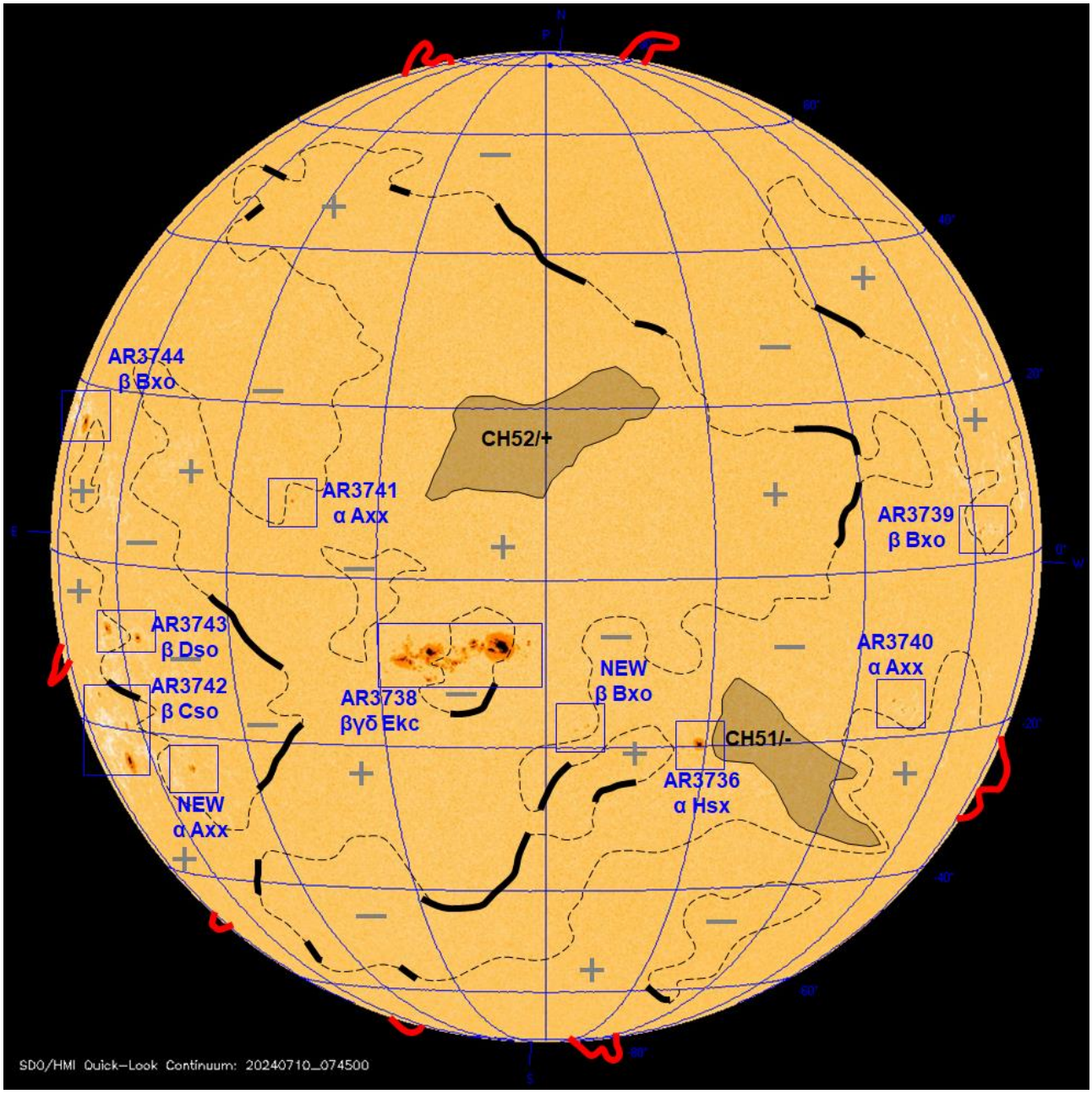
Energetic Particles / Solar Radiation: Solar radiation storms are not expected, but there is a very slight chance of reaching S1/Minor Radiation Storm or greater levels. This risk increases a little later in the period as AR3738, currently in the southeast, rotates towards centre disc and into a more geoeffective position.
High energy electron flux is expected to remain mostly at background levels through this period, with the Active (1e8 integrated pfu) fluence threshold not expected to be reached.

Figure 1. Solar Analysis Valid 0800UTC, 10 July 2024.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No anticipated Earth-directed CMEs feature in the forecast.
The solar wind at slow-ambient to elevated levels for the remainder of day 1 (10 Jun). Two successive negative coronal holes in the southwest may bring more general slightly elevated or perhaps briefly elevated wind speeds later on day 1 until early day 3 (10-12 Jul). Significant geomagnetic activity from either of these features is considered unlikely due to their ill-defined appearance and Earth's proximity to the solstice.
A prominent and large, positive coronal hole (CH52/+) is currently transiting across centre disk in the northern hemisphere. This coronal hole is likely to connect with Earth around day 3 (probably the second half of the day) or connect during day 4 (12-13 Jul), with a related High Speed Stream (HSS) and solar winds probably reaching elevated levels, to around 500-600 km/s. This feature is dark in appearance and well defined alluding to the fast wind emanating from this coronal hole to be the most significant of any coronal holes currently on the disk. This HSS will last two to three days with a gradual decline expected once the peak has occurred.

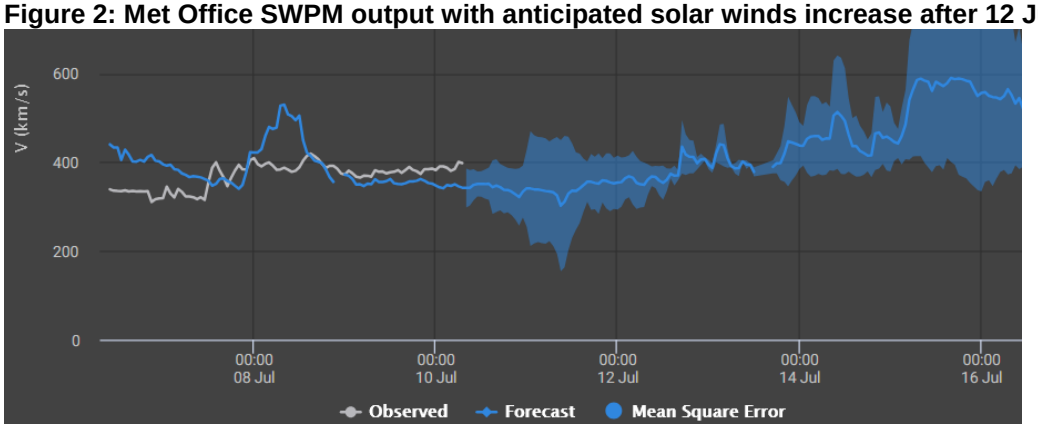
Geomagnetic activity is expected to be mainly Quiet to Unsettled (Kp1-3) through the period. There is a chance of an active interval, especially later on day 2 (11 Jul). The Chance of Active to G1/Minor storm intervals (Kp4-5) increases by days 3 and 4 (12-13 Jul) due to successive coronal hole fast wind enhancements.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	5	50	40
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: Met Office SWPM output with anticipated solar winds increase after 12 July.



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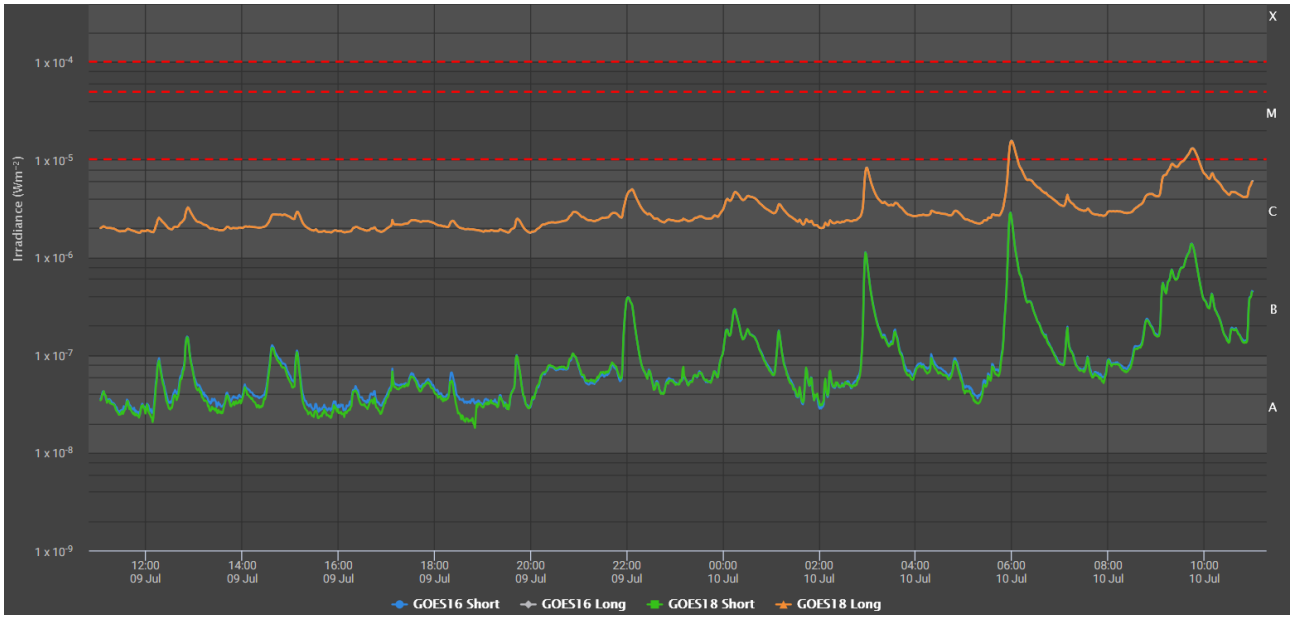
Radio Blackouts - X-Ray Flares:
Solar activity is Moderate with three M-class flares observed in recent hours, along with baseline flux contained within C-class over the past 24hrs. One of the M-class flares peaking at M1.5 at 10/0559 UTC from AR3738.

There are eight numbered and two unnumbered regions on the disc. AR3738 in the southeast is by far the largest and most complex region on the disc, showing continued growth trend in penumbral area in its intermediate spots and beta-gamma magnetic configuration with a probable delta spot now evident. AR3743 also in the southeast but closer to the limb, has also displayed recent slight growth in penumbral extent but remains relatively simple. There are two unnumbered simple regions with the rest of the numbered regions appearing small and magnetically simple.
There is an increasing chance of further M-class flares, from AR3738, and a chance of an X-class flare.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	60	60	60	70
Very Active	R3 to R5 X Class	No	15	15	20	20

Figure 3: X-ray flux at GEO with a couple of M-class flares in recent hours.



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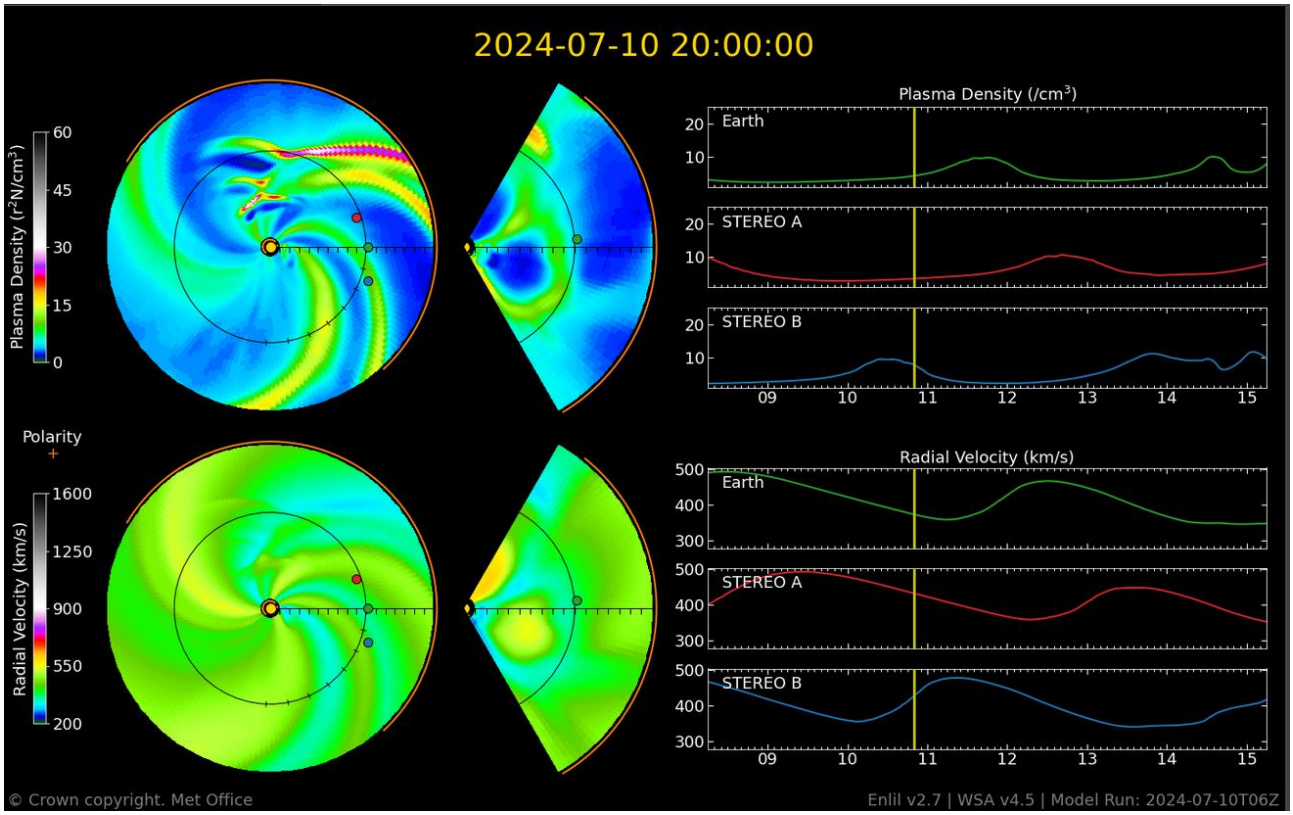
Solar Radiation Storms - (High Energy Protons):
High energy proton flux at GOES18 is at background levels. It is most likely to remain that way, but with a slight chance of exceeding the S1/Minor radiation storm threshold should any larger flares occur, mainly from AR3738. Considering the region still resides in the southeast disc, it is still in an unfavourable location for significant proton enhancements to be detected at Earth following any notable flares. As the region rotates towards the southwest, the probability of exceeding S1 increases slightly, but still remains low.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	15	20
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Met Office ENLIL latest run.



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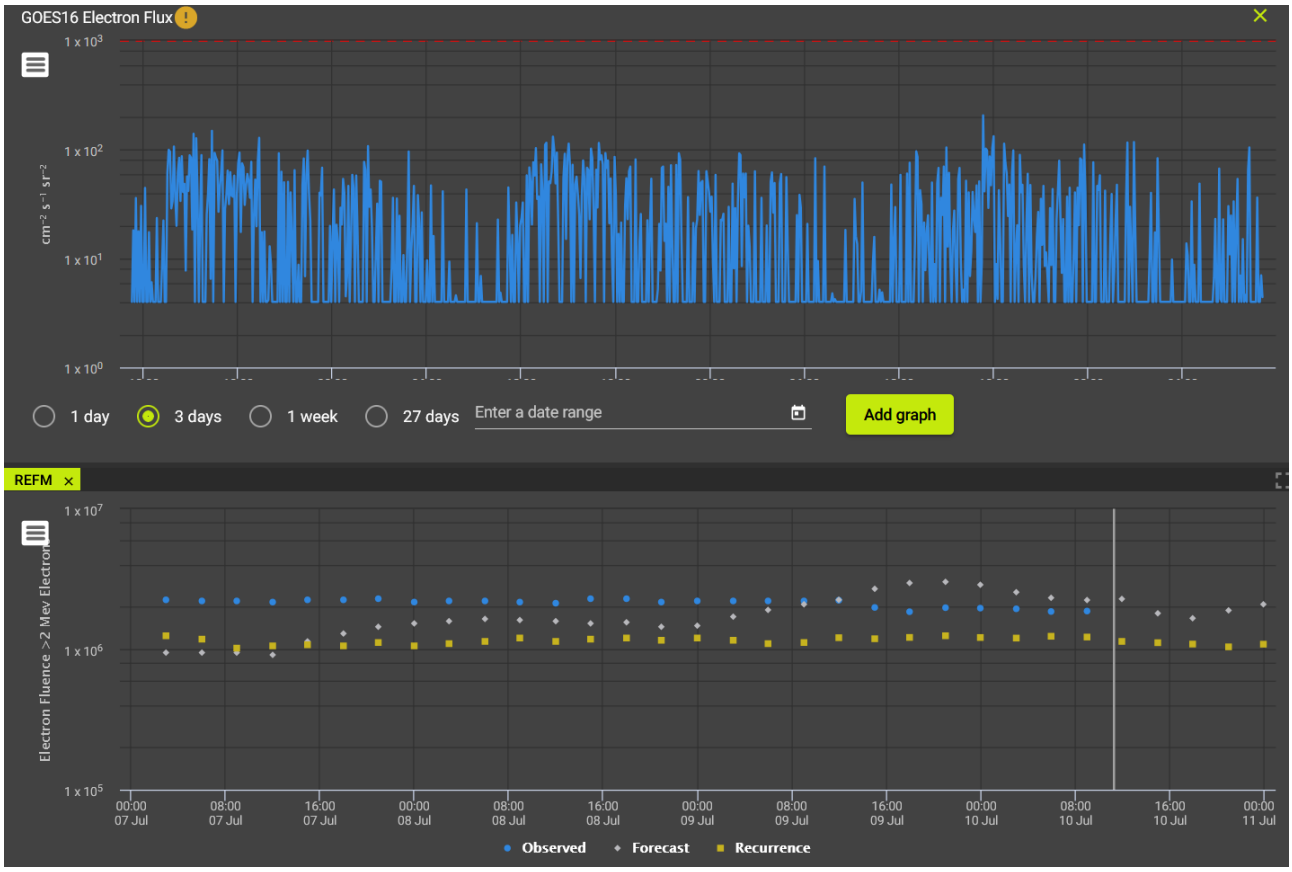
High Energy Electrons Event (≥ 2MeV):
High energy electron flux recorded at GOES16 has been at mostly background levels and is expected to remain that way for much of the forecast period. Later in the period, the arrival of coronal hole fast winds may serve to suppress and charge the Van Allen belts, perhaps leading to a rise in flux towards the end of this forecast period. MOSWOC REFM output is considered good guidance, with a generally flat trend indicated through the period, well below the Active 1e8 integrated flux threshold.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: High energy electron flux at GEO and Met Office REFM output indicating little overall change in coming days.



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